

Financial Assistance Award

DENALI COMMISSION
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Award Number

01194-01

Award Title

Emerging Technologies Projects

Performance Period

September 30, 2009 through September 30, 2012

Recipient Organization & Address

University of Alaska Fairbanks
PO BOX 757880
3295 COLLEGE ROAD 109 ASC
Fairbanks, AK 99775-7880

Authority

112 Stat 1854

CFDA Number

90.100

Denali Commission Finance Officer Certification

Jennifer Price
02/22/2010

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Recipient DUNS # 615245164

TIN # 926000147

Cost Share Distribution Table

Accounting Code	New Funding		Prior Period Funding		Total
	Denali Commission	Other Contributors	Denali Commission	Other Contributors	
95670000AL	(\$3,239,367.00)		\$4,000,000.00		\$760,633.00
	\$0.00		\$0.00		\$0.00
	\$0.00		\$0.00		\$0.00
	\$0.00		\$0.00		\$0.00
	\$0.00		\$0.00		\$0.00
		\$0.00		\$0.00	\$0.00
		\$0.00		\$0.00	\$0.00
		\$0.00		\$0.00	\$0.00
		\$0.00		\$0.00	\$0.00
Total	(\$3,239,367.00)	\$0.00	\$4,000,000.00	\$0.00	\$760,633.00

This Financial Assistance Award approved by the Federal Co-Chair of the Denali Commission constitutes an obligation of federal funding.

Amended Award Conditions to the Financial Assistance Award Between the Denali Commission and University of Alaska Fairbanks (UAF), Alaska Center for Energy and Power (ACEP) For Emerging Technologies Projects, Award No. 01194, Amendment 1

Continued on the following pages

Signature of Authorized Official - Denali Commission

Electronically Signed

Typed Name and Title

Joel Neimeyer
Federal Co-Chair

Date

02/18/2010

AWARD ATTACHMENTS

University of Alaska Fairbanks

01194-01

1. Amended Award Conditions - Emerging Technologies Projects

***Award Conditions to the Financial Assistance Award
Between the Denali Commission and University of Alaska Fairbanks (UAF),
Alaska Center for Energy and Power (ACEP)
For Emerging Technologies Projects
Award No. 01194, Amendment 1
January 2010***

All changes to the award conditions are noted below.

1. Scope of Work

This Amendment takes the following funding actions:

- a. Reduces that total amount by \$3,239,367 from this award to be allocated to individual projects, leaving a balance on this Award totaling \$760,633.

The following scope conditions are added via this Amendment.

- a. \$200,000 remains dedicated to project administration (5% of the original \$4m total)
- b. \$560,633 for data collection, processing, and independent reporting for the Emerging Energy Technologies Grants (EETG). The original data collection budget totaled \$300,000 however due to the increased number of funded projects, the budget is increased to \$560,633. No administrative fees are being charged on the increase. Each project has a projected data collection scope and budget as detailed below.

ACEP shall implement a uniform data collection strategy across all projects, and implement a similar project assessment protocol to ensure fair and consistent recommendations and conclusions. This shall include:

- a. Assisting grant recipients in developing a data collection and reporting plan for implementation as part of each award.
- b. Compiling and analyzing data, providing easy-to-understand and streamlined reports on project performance, reliability, efficiency, operating costs, repairs, and any areas of concern.
- c. Providing recommendations for go/no-go decision making points at critical, predefined intervals during each project.
- d. Providing a final report packaging all data from the projects and providing a recommendation on future use of the technology in Alaska at the end of the demonstration project phase (expected to be 1 to 2 years). Final reports shall be submitted to Denali Commission for final approval as a condition for award closeout.

In order to accomplish these tasks, ACEP will assign a technical lead to each project. This individual will be a UAF researcher with expertise in the particular technology being tested. Additionally, a staff energy economist will track economic parameters associated with all projects. The cost of these activities is estimated in an independent budget for each project. Changes are allowable based on written mutual consent between the Denali Commission (Commission) and ACEP. Scope or budget changes within each

data collection/reporting scope are allowable with mutual consent of ACEP and the Commission, however any changes to the overall award are subject to amendment to the award.

Data Collection Equipment Purchase

Each of the following data collection budgets includes the purchase of equipment (i.e. monitoring units, etc.) to carry out the goals of the grant. This equipment will become the property of the UAF upon completion of this grant and shall be used as possible to continue the goals of the EETG program. A condition of the closeout report for this award requires that a full inventory of equipment be submitted and accompanied by a written plan that identifies future use and/or disposition of these items. Due to the high percentage of funding dedicated in this grant toward data collection equipment (45%), this further supports the value of both the Commission and ACEP's role in furthering the EETG program beyond the life of this grant agreement.

Detailed data collection scopes for each project are outlined below:

High Penetration Hybrid Power System (ACEP Data Collection Budget - \$65,813)

The Wind Diesel Application Center's goal for this project is to analyze state of the art power electronics to assess options for wind-diesel hybrid power systems to operate in a diesel-off mode. Project funding is \$433,045 to the Wind Diesel Application Center under UAF. Phase 1 report data and analysis will focus on the corroboration of the electronics review and technology selection for Phase 2 testing, with recommendations, lessons learned, and a summary of experiment specifics for Phase 2, per Phase 1 results. The final report will take the comprehensive data from the project and provide overall analysis, lessons learned, and recommendations for the technology. Included will be the overall potential application and replication of the technology under various locations, climates, and power supply situations.

Wales Diesel-Off High Penetration Wind System (ACEP Data Collection Budget - \$65,359)

Kotzebue Electric Association's overall goal for this project is to demonstrate diesel-off configuration for a remote wind-diesel hybrid power system through the retrofit of existing equipment and controls. Project funding is \$155,000 awarded to the Kotzebue Electric Association (KEA). Data collection for Phase 1 will target analysis of the design, procurement, installation, and commissioning of the project. Of special interest will be data that contributes to the overall economic analysis of the project, such as procurement costs, installation issues, etc. Data collection for Phase 2 will target analysis of system performance. Inherent in the retrofit is the ability to gather vast quantities of system data, and Phase 2 will require the ability to sift through the data and analyze meaningful metrics for the purpose of the EETG. Of particular interest will be to compare the system performance before and after the retrofit, and to analyze the ability of the system to meet the diesel-off configuration, as well as parameters, barriers or opportunities to meet this

objective. System load data, wind speeds, environmental conditions, etc, will be used for systems analysis including annual, seasonal and daily framework.

Psychrophiles for Generating Heating Gas (ACEP Data Collection Budget - \$48,965)

The goal of this project is to demonstrate the efficiencies of mesophile (conventional digester microbes) and psychrophiles on common household and rural Alaska feedstock at various cold temperatures, and the deployment of digester(s) in practical household scale project(s) to operate appliances and an electrical generator to evaluate feasibility and sustainability in an applied setting for widespread use in Alaska. Project funding is \$250,910 to the recipient Cordova Electric Cooperative (CEC). Data collection for Phase 1 will target comparative analysis of mesophile and psychrophiles organisms. At a minimum level, daily log measurements of product gas flow rates, digester temperature, and ambient temperature will be collected. Samples of product gas will be analyzed at UAF as specified in the proposal, while daily log data and digester conditions will be measured on site by the Cordova High School science class, monitored by Adam Lowe and CEC staff. Other specific data, such as digester conditions, feedstock variables, organism data, etc, will be determined with the grantee and integrated into the analysis and reporting where pertinent. Go/no go decisions will be made through mutual consent of Denali Commission and ACEP regarding Phase 2 scope and necessary data collection methods. Data collection for Phase 2 will target similar data as in Phase 1, but with a broader focus on deployment testing. Systems data will include flow rates, gas composition, the effects of temperature, feedstock comparison, efficiency analysis, end use testing, and digester construction material.

Wood Pellet Boiler Conversion Signature Project (ACEP Data Collection Budget - \$64,717)

Sealaska's overall goal of this project is to demonstrate that wood heat can be cost effective and feasible for larger commercial, industrial, and municipal buildings, and the change in demand for Southeast Alaska second growth wood fiber. Project funding is \$510,000 for Sealaska Corporation. Data collection for Phase 1 will target analysis of the procurement, installation, and commissioning of the project. Of special interest will be data that contributes to the overall economic analysis of the project, such as procurement costs, installation issues, etc. Instrumentation will not be needed for this phase. Data will be collected through the project manager, contractors, manufacturers, and other involved parties. Data collection for Phase 2 will target analysis of system performance. Of particular interest will be measuring the efficiency of the boiler, with factors such as pellet feed rate, produced energy, and ambient temperature being measured, with the overall goal of providing system-wide performance data.

Seawater Heat Pump Demonstration Project (ACEP Data Collection Budget - \$57,747)

The Alaska SeaLife Center's overall goal for this project is to demonstrate a heat pump system that will "lift" latent heat from raw seawater and transfer the energy into building heat. Project funding is \$426,720 for the Alaska Sealife Center for the purchase and

installation of the first of two pumps. A second pump is included in the Alaska Energy Authority (AEA) Renewable Energy Program (REP) recommended project list and is pending state legislative approval. Data collection for Phase 1 will target analysis of the design, procurement, installation, and commissioning of the project. Of special interest will be data that contributes to the overall economic analysis of the project, such as procurement costs, installation issues, etc. Instrumentation will not be needed for this phase. Data will be collected through the project manager, contractors, manufacturers, and other involved parties. Data collection for Phase 2 will target analysis of system performance. Of particular interest will be measuring the Coefficient of Performance (COP, the ratio of electric energy in vs. heat energy out). Other measured parameters will be the ocean temperature, and flow rate and temperature of both the inlet and outlet water streams, with the overall goal of providing system-wide performance data.

Organic Rankine Cycle Heat Recovery System (ACEP Data Collection Budget - \$64,961)
Tanana Chiefs Conference's (TCC) goal for this project is to demonstrate the potential improved fuel efficiency of the diesel power plant in a village in the TCC region through the use of an Organic Rankine Cycle (ORC) system for heat recovery from engine jacket water and exhaust. Project funding is \$250,000 for the Tanana Chiefs Conference (TCC). Data collection and analysis will focus on first phase tasks, verification of the performance and reliability of a selected ORC system. The tasks currently included under the TCC scope of work include:

- 1) 1,000-hour reliability test of the ORC system under full load.
- 2) 50-hour test of the ORC system performance under controlled environmental conditions to evaluate the extent to which the ORC technology is ready for application in the selected village diesel power plant and how to optimize the performance of the ORC system under varying load and weather conditions.

Results will include data on system performance, installation and operational/maintenance requirements, system selection recommendations for varying load conditions, and an economic impact analysis. Corrosion issues shall be considered and addressed in the final report. The ACEP team identified under this proposal will coordinate with the TCC project team to ensure adequate and complete data collection, as well as adequate data analysis for the needs of this solicitation. If the second phase of this initiative is funded, the ACEP team will coordinate data and reporting to provide a holistic project report.

Feasibility of Solar Hot Water Systems (ACEP Data Collection Budget - \$63,857)
Kotzebue Electric Association's goal for this project is to investigate and test the feasibility of solar hot water heating systems applied to elder residential units in the NANA region. Project funding is \$110,000 for the KEA. Data collection for Year 1 will target the chosen technology, procurement, installation, and initial operational and performance data from an annual operations cycle. Data collection for Year 2 will target operations, maintenance, performance data from an annual operations cycle, and pertinent comparative data. Also targeted will be go/no-go decisions, project

ramifications, technology or systems lessons learned, and economic data to support a comprehensive economic analysis.

Nenana Hydrokinetic Turbine (ACEP Data Collection Budget - \$65,974)

Ocean Renewable Power Corporation's (ORPC) goal for this project is to assess and demonstrate the potential of hydrokinetic technology in Alaska. Project funding is \$830,325 for the ORPC. Data collection for Phase 1 will target the results of the turbine testing in Maine, including turbine performance, lessons learned, and any project or technology modifications made as a result of initial testing. Also targeted will be the results of Alaska Hydrokinetic Energy Research Center (AHERC) studies on the resource, including investigation of debris, and technology investigations, including debris shield and foundations. At this stage, efforts will be made by ACEP to make sure relevant project data is being investigated and communicated between AHERC and ORPC, and that pertinent information is reported to the Denali Commission and the general public. Data collection for Phase 2 will target the results of the turbine being deployed at Nenana, including turbine performance, grid integration results, lessons learned, and any relevant feedback data pertinent to Phase 1 collection (such as foundation or debris shield lessons learned). Phase 2 will also feature economic analysis, looking at feasibility, applicability, and replicability of the project on an economic basis.

Flow Battery Energy Storage Systems (ACEP Data Collection Budget - \$63,240)

Kotzebue Electric Association's goal for this project is to investigate and test advanced flow battery systems, and their potential application to energy systems in Alaska. Flow battery technology is a form of rechargeable battery in which dissolvable electrolytes are utilized to transform into electricity; differing from typical batteries in which electrolytes are stored outside the battery, allowing for independent scaling of power and electricity. The potential application in small villages could provide significant grid stabilization and load shifting, specifically integrating wind technology. Project funding is \$500,000 to the KEA. ACEP's data collection, analysis, and reporting work on this project will target technology operations, performance, and maintenance as well as economic analysis and lessons learned. Data collection activities are not authorized until the project grant has been executed.

2. Award Performance Period

The amended Award performance period is September 30, 2009 through September 30, 2012. This is the period during which Award recipients can incur obligations or costs against this Award.

There are no other changes to the original Financial Assistance Award, as amended.